Cross-linking for hardness and water resistance of mussel adhesive protein

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Mussel adhesive proteins (MAPs) which can strongly affix to the wet surfaces, maintain its adhesive force and flexibility in harsh conditions. By making protein bond, they can alter their property to be hard and withstand all hardships. We successfully expressed MAP, fp-151, in *Escherichia coli* system and modified fp-151 *in vitro* in order to make a 3,4-dihydroxyphenylalanine(DOPA)-containing MAP. To date, DOPA is believed as a key amino acid for adhesion. In mussel, DOPA covalently crosslink itself (auto-cross-linking) or form a multiple metal mediated ligands. In this study we tried to crosslink MAP and check the hardness of protein with water resistance effects by means of additives and 3 types of surfaces. We assumed that water resistance force is coming from protein cross-linking not only adhesion force. Firstly, we tried out to make DOPA in protein using tyrosinase for auto-cross linking and there is another way to make DOPA containing protein *in vitro*. Therefore, we did experiment with modified MAP. In addition, we also treated sodium periodate (NaIO4) for metal ion chelation. Besides, we added glutaraldehyde to MAP which form the bonds predominantly with amino groups.